SYSTEM AND METHOD FOR USING SIGNAL WAVEFORM ANALYSIS FOR DETECTING A CHANGE IN A WIRED NETWORK

RELATED APPLICATIONS

[0001] The present application is a Continuation of U.S. application Ser. No. 16/464,307, filed May 28, 2019, which is a U.S. national phase of International Application No. PCT/IL2017/051259 that was filed on Nov. 18, 2017 and which claims the benefit of U.S. Provisional Application Ser. No. 62/430,988 that was filed on Dec. 7, 2016, which are hereby incorporated herein by reference.

TECHNICAL FIELD

[0002] This disclosure relates generally to an apparatus and method for monitoring, isolating, and securing activity of a wired network by physical layer analyzing of a received signal waveform, and in particular, to detect by the waveform analysis of a change in the wired network, such as connection of an authorized device or an unauthorized substitution of a device communicating over the network.

BACKGROUND

[0003] Unless otherwise indicated herein, the materials described in this section are not prior art to the claims in this application, and are not admitted to be prior art by inclusion in this section.

[0004] Physical layer (PHY). The Open Systems Interconnection (OSI) model, which is defined by the International Organization for Standardization (ISO) and is maintained by the identification ISO/IEC 7498-1, includes seven-layers. The physical layer or layer 1 is the first and lowest layer. The physical layer consists of the basic networking hardware for transmission technologies of a network. It is a fundamental layer underlying the logical data structures of the higher level functions in a network. The physical layer defines the electrical and physical specifications of the data connection. It defines the relationship between a device and a physical transmission medium (e.g., a copper or fiber optical cable and radio frequency). This includes the layout of pins, voltages, line impedance, cable specifications, signal timing and similar characteristics for connected devices and frequency (5 GHz or 2.4 GHz etc.) for wireless devices. It is responsible for transmission and reception of unstructured raw data in a physical medium. It may define transmission mode as simplex, half-duplex, and full duplex. It further defines the network topology as bus, mesh, or ring being some of the most common.

[0005] The physical layer defines the means of transmitting raw bits rather than logical data packets over a physical link connecting network nodes. The bit stream may be grouped into code words or symbols and converted to a physical signal that is transmitted over a hardware transmission medium. The physical layer provides an electrical, mechanical, and procedural interface to the transmission medium. The major functions and services performed by the physical layer are bit-by-bit or symbol-by-symbol delivery, providing a standardized interface to physical transmission media, including mechanical specification of electrical connectors and cables, for example maximum cable length, electrical specification of transmission line signal level and impedance, radio interface, including electromagnetic spectrum frequency allocation and specification of signal strength, analog bandwidth, modulation, line coding, bit synchronization in synchronous serial communication, start-stop signaling and flow control in asynchronous serial communication, circuit switching, multiplexing, establishment and termination of circuit switched connections, carrier sense and collision detection (utilized by some level 2 multiple access protocols), equalization filtering, training sequences, pulse shaping and other signal processing of physical signals, forward error correction, bit-interleaving and other channel coding. The physical layer is also concerned with bit rate, point-to-point, multipoint or point-to-multipoint line configuration, physical network topology, for example bus, ring, mesh or star network, serial or parallel communication, simplex, half duplex or full duplex transmission mode, and auto-negotiation.

[0006] Medium. In a communication network, multiple devices or stations that implement some part of the communication protocol are communicating over a transmission medium, which is a transmission path along which a signal propagates, such as a wire pair, coaxial cable, waveguide, optical fiber, or radio path. Such a medium may include any material substance, such as fiber-optic cable, twisted-wire pair, coaxial cable, dielectric-slab waveguide, water, and air, which can be used for the propagation of signals, usually in the form of modulated radio, light, or acoustic waves, from one point to another. A free space is typically also considered as a transmission medium for electromagnetic waves, although it is not a material medium. A medium that consists of a specialized cable or other structure designed to carry alternating current of radio frequency, that is, currents with a frequency high enough that their wave nature must be taken into account, is referred to as a transmission line. Transmission lines are commonly used for purposes such as connecting radio transmitters and receivers with their antennas.

[0007] The transfer of information such as the digital data between two nodes in a network commonly makes use of a line driver for transmitting the signal to the conductors serving as the transmission medium connecting the two nodes, and a line receiver for receiving the transmitted signal from the transmission medium. The communication may use a proprietary interface or preferably an industry standard, which typically defines the electrical signal characteristics such as voltage level, signaling rate, timing and slew rate of signals, voltage withstanding levels, short-circuit behavior, and maximum load capacitance. Further, the industry standard may define the interface mechanical characteristics such as the pluggable connectors and pin identification and pin-out. In one example, the module circuit can use an industry or other standard used for interfacing serial binary data signals. Preferably, the line drivers, the line receivers, and their associated circuitry will be protected against Electro-Static Discharge (ESD), electromagnetic interference (EMI/EMC) and against faults (fault-protected), and employs proper termination, failsafe scheme and supports live insertion. Preferably, a point-to-point connection scheme is used, wherein a single line driver is communicating with a single line receiver. However, multi-drop or multi-point configurations may as well be used. Further, the line driver and the line receiver may be integrated into a single IC (Integrated Circuit), commonly known as transceiver IC. A device that transmits data to a medium typically uses a line driver, which commonly includes an electronic